A NEW PINE LEAF RUST.

(*Coleosporium pini*, n. s.)

By B. T. GALLOWAY.

Early in May of the present year we found on the leaves of *Pinus inops*, near Washington, a *Coleosporium* which appears to be new, and which may be briefly characterized as follows:

COLEOSPORIUM PINI, *n. s.*—III Amphigenous. Sori reddish orange, 1 to 5^{mm} long, or when confluent frequently attaining a length of 10^{mm} or more; spores irregularly clavate, smooth, 2 to 4 celled, 70–125 by 18–25μ. Forming yellow spots 4 to 25^{mm} or more long at or near the ends of *Pinus inops* leaves. The spores germinate readily in moist air by sending out one unseptate promycelium from each cell; upon the free ends of these tubes, which are of various lengths, the orange red sporidia are borne. Finding the *Coleosporium* nearly always associated with *Peridermium cerebrum*, Pk. led me to believe that it might be the teleutosporic form of this fungus. Cultures are being made to settle this and other questions connected with these interesting parasites, but as it will be at least a year before definite results can be obtained we have thought it best to briefly describe the *Coleosporium* here.

OBSERVATIONS ON NEW SPECIES OF FUNGI FROM NORTH AND SOUTH AMERICA.

By Prof. G. LAGERHEIM.

A NEW HOLLYHOCK RUST.

(Plate x.)

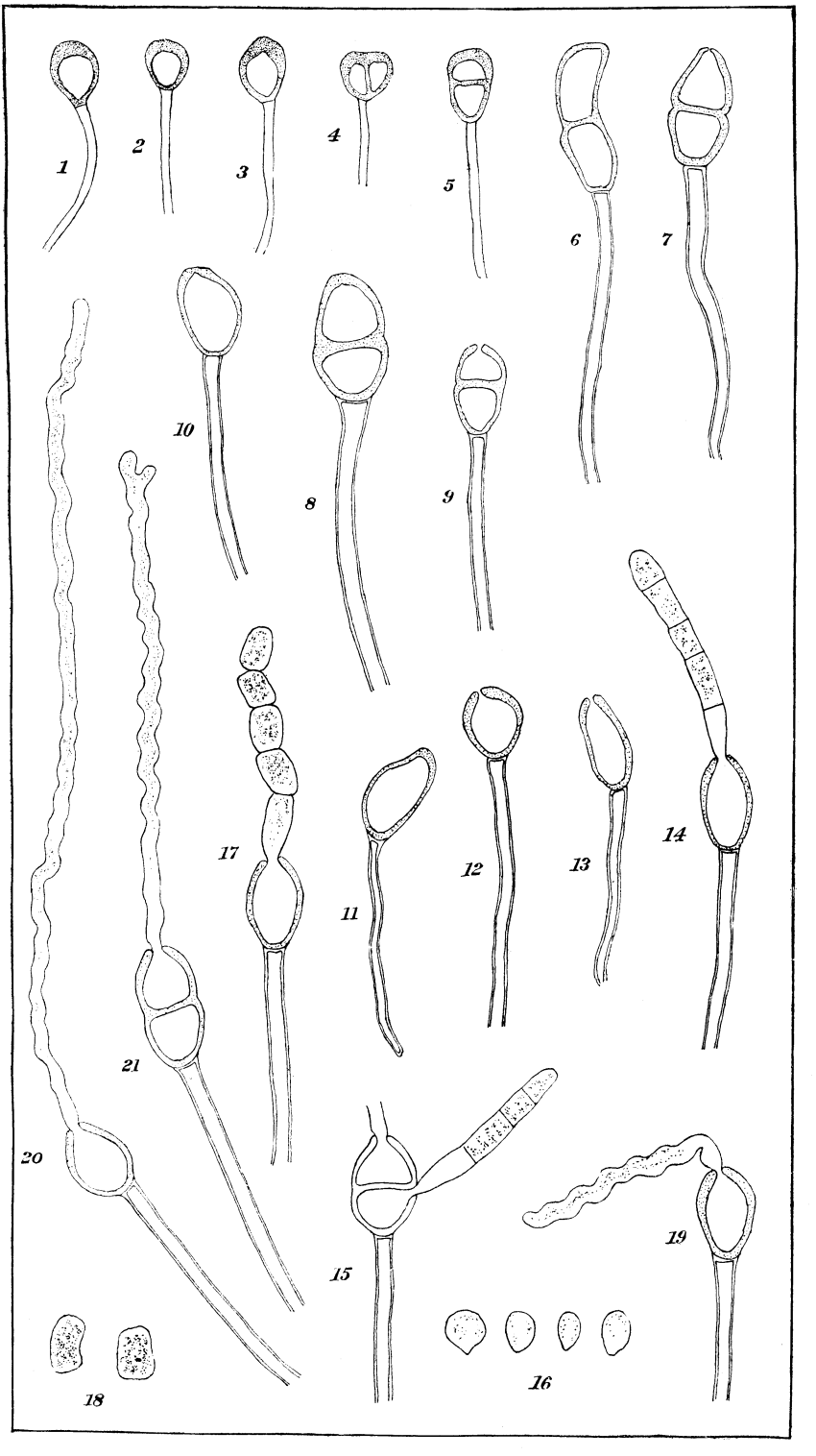
The Hollyhock (*Althæa rosea*) has several enemies among fungi. The most dangerous diseases of this ornamental plant are, as far as known, caused by *Puccinia malvacearum*, Montagne; *Cercospora althæina*, Sacc.* Recently Miss Southworth has directed attention to a new and dangerous disease of the Hollyhock caused by *Colletotrichum malvarum*,† (Br. & Casp.) South.

In the following lines I will describe a new Hollyhock disease caused by a fungus closely allied to and fully as dangerous as *Puccinia malvacearum*, Mont. As *P. malvacearum* has found its way from South America to Europe, it is not impossible that *P. heterogenea*, n. s., may also attack the Malvas of the Old World.

More than a year ago, while passing over the road between Guayaquil and Quito for the first time, I observed at several stations, viz, Chimbo, Guaranda, Mocha, etc., a rust on Malva which presented considerable

*B. D. Halsted, Garden and Forest, March 26, 1890.

†E. A. Southworth. A New Hollyhock Disease. Jour. Myc., VI, No. 2, p. 45, Plate III.



LAGERHEIM, ON A NEW HOLLYHOCK RUST.

microscopic likeness to *Puccinia malvacearum*. Since *P. malvacearum* originated in South America, I supposed I had found the fungus in its native place. Arriving at Quito, I found the same fungus everywhere on different species of Malva and on Hollyhocks, to which it was apparently very injurious. I soon learned from several gardeners that Hollyhocks did not thrive well in winter and often perished from a disease which manifested itself by large numbers of brown spots on the leaves and stems. I was also shown some of these diseased plants bearing the brown spots, in which I immediately recognized my *Puccinia* on *Malva*.

It struck me, however, that the sori were in general distinctly larger than those of *P. malvacearum*, which I have observed in several places in Europe, and therefore I made a microscopic examination. To my astonishment I saw at the first glance that the fungus was not *P. malvacearum*, Mont. at all, but an entirely different Puccinia. It more resembled *P. heterospora*, B. & C., and at first I thought I had this species before me, but on a closer comparison of the two fungi it soon became apparent that the fungus was also very clearly distinct from *P. heterospora*, B. & C., and must be looked upon as a new species.

On account of a peculiarity of its spores, which will be alluded to directly, I have called the fungus *Puccinia heterogenea*.

The fungus is found during the entire year on *Malva nicæensis*, *M. crispa*, *M. Peruviana*, and *Althæa rosea*,* and is especially plentiful in winter (January to May), but it could never be found on several Sida species which grew in the immediate neighborhood of the diseased Malvas. It occurs on all the green parts of the plant, especially on the leaves; on these it is almost exclusively on the under side, while on the upper side it causes roundish, strongly concave spots, which are reddish in the center and yellowish at the edges. The sori are about a millimetre in diameter and are crowded together, forming a large, strongly projecting, chestnut-brown cushion several millimetres in diameter; and on the thicker portions of the stems they are more than a centimetre long and a half centimetre broad. Around the spore masses and between the single sori are visible shreds of the ruptured epidermis of the leaf. The sori contain only teleutospores, which under proper conditions germinate immediately after ripening; the fungus, therefore, belongs to the class *Leptopuccinia*. The teleutospores occur in two forms, one-celled, which is the preponderating kind, and two-celled. The one-celled spores (Figs. 10–13) are roundish ovate, elliptical, or elongated, 30–45μ long, and 20–30μ broad; the two-celled spores (Figs. 6–9) are elliptical or ovate above, rounded or tapering below, and little or not at all constricted in the middle. The membrane of the spore is yellowish, little or not at all thickened at the apex of the spore and perfectly smooth. The germ pore of the upper half of the spore

*I have also seen the fungus in a botanical garden of this country very abundant on a Malva grown from European seed, but unfortunately not definitely determined.

lies at the apex and that of the lower half close to the dividing wall, as appears to be the case in nearly all Leptopuccinias. The pedicel is very long, three or four times as long as the spore, and nearly hyaline. The spore contents are reddish.

Among the species of Puccinia occurring upon the Malvaceæ (*P. sherardiana*, Kornicke; *P. lobata*, B. & C.; *P. abutili*, B. & Br.; *P. carbonacea*, Kalchbr. & Cke.; and *P. heterospora*, B. & C.) only one, *P. heterospora*, B. & C., resembles *P. heterogenea*. Both species have this in common, that they have one-celled as well as two-celled teleutospores; but in other respects they are entirely different. In the two-celled spores of *P. heterospora* (Figs. 4, 5) the septum occupies very different positions, while in *P. heterogenea* it always has its normal position (Figs. 6–9). In *P. heterospora* the two celled spores occur very rarely, while in *P. heterogenea* they are very frequent. The differences come out very sharply when the two species are examined mingled together in the same preparation. Even macroscopically the two species can be easily distinguished from each other. In *P. heterospora* the single sori are smaller and darker colored and stand very many together. Finally there is a difference in the choice of host plants of the two species. *P. heterospora* attacks mainly species of *Sida* and *Abutilon*,* and not *Malva*. With *P. heterogenea* the opposite is the case. *Puccinia heterospora* appears to prefer a tropical or subtropical climate, while *P. heterogenea* has up to this time been found only in regions with a temperate climate. On this account it is not impossible that *P. heterogenea* may occur in North America or in Europe.

The germination of spores takes place very rapidly. Fresh masses which had been kept in a moist chamber produced promycelia and sporidia from almost all their spores in a few hours. The promycelium divides into from four to six cells, the lowest one of which soon loses its contents and is incapable of further development (Figs. 14, 15). The formation of sporidia takes place in the manner typical of the Leptopuccinias. In very moist air the promycelium often falls apart into single cells (Figs. 17, 18). The process of germination is quite different when the spores are in water. They then germinate exactly like uredospores; a long, non-septate germ tube, often bent backward and forward, and with a strongly undulating contour, (Figs. 19–21), grows out of the germ pore. Occasionally the commencement of branching has been observed at the end of the germ tube (Fig. 21). Probably the fungus can reproduce itself by these germ tubes, which, because they form no sporidia, penetrate directly into the leaf. But it is clear that this method of reproduction is of much less importance than reproduction by sporidia. At the most, each spore can produce two germ tubes, and these can only penetrate into the same leaf

* Compare Seymour, Distribution of *Puccinia heterospora* (Journal of Mycology, Vol. 1, p. 94). In previous years in Jamaica I found the species on *Abutilon indicum A. periplocifolium*, and *Sida ciliaris*.

or one very close to it, because they are attached to the germ tube of the spore, and the spore itself does not become separated from its pedicel. If, on the contrary, the spore germinates in the air numerous sporidia are formed, which may be carried away by the air, etc., and will spread the fungus far and wide. In consequence of this it follows that it is of great advantage for the fungus that the sori should break out on the under side of the leaf. If they made their appearance on the upper side they would be wet by the rain and germinate by germ tubes. The different modes of germinating above described (which I have, moreover, noticed for other Leptopuccinias*) explains why nearly all Leptopuccinias form their sori mainly or exclusively on the under sides of the leaves. What the cause (light?) of this is remains to be ascertained.

A description of this species is given below: *Puccinia* (lepto) *heterogenea*, n. s. P. maculis epiphyllis rotundatis vel rotundato angulatis, medio purpureis lutescenti marginatis concavis; soris teleutosporarum hypophyllis vel caulicolis, pulvinatis, prominulis, congregatis, castaneis, mox nudis; teleutosporis continuis vel bicellularibus, ovoideis, oblongis, vel ellipsoideis apice et basis rotundatis vel parum attenuatis, membrana levi, luteola ad apicem paullulum vel non incrassata et pedicello hyalino teleutospora 3–4-plo longiore, persistente præditis. Long. teleutosp. 30–60μ; lat teleutosp. 20–30μ.

Hab. in foliis et caulibus vivis *Althææ rosæ*, *Malva crispæ*, *M. Peruvianæ*, *M. nicæensis* ad Quito, Mocha, Chimbo, Guaranda et aliis locis Æquatoriæ.

A NEW COTTON RUST IN ECUADOR.

Cotton, like other cultivated plants, is attacked by different kinds of fungi. Atkinson has recently described a new *Ramularia* on *Gossypium herbaceum* in Alabama. It is striking that up to this time no Uredineæ have been observed on the cotton plant, as the Malvas belonging to the same family are attacked by numerous species of rusts. This I think justifies the publication of a new Uredo on Gossypium, especially as the disease thus caused is very injurious, and the cotton one of our most important cultivated plants. I discovered the fungus in the following manner: On December 10 of the preceding year I took a trip from Quito to Guayaquil to study the fungi and algæ of the tropical region. By December 15 I had arrived at Balsapamba (Province of Los Rios), in the tropical region on the Rio Crystal, where I stopped for a day. The owner of the "casa ponada," Senor Vasquez, took me around his plantation of coffee, oranges, and pineapples, and in the pineapple garden I noticed the diseased cotton plants. Senor Vasquez had planted here some of the shrub-like Gossypium, ordinarily planted in the equatorial coast region, and which yields large crops of good

* The same thing appears in Gymnosporangium. Compare Kienitz-Gerloff in Botanische Zeitung, 1888, p. 389, and Richards in Bot. Gazette, 1889, No. 9.

cotton. But he complained that his plants were diseased and only yielded a little cotton. In fact, the bushes with their dead and fallen leaves presented a very sorry appearance, and even the leaves that were still green were apparently attacked by a disease which showed itself in the form of very numerous small spots. I took a few leaves with me, believing it was a Sphæriacea or Sphæropsidea which had attacked the green parts of the plant. A few days later, when I arrived in Guayaquil, I examined the fungus microscopically, and was very much surprised when I found it to be a Uredo. On my return to Quito I stopped at Balsapamba to collect more of the fungus, but the disease had advanced so far that nearly all the leaves had fallen off and were destroyed. The rainy weather at the end of December and the beginning of January had apparently favored the growth of the fungus very much.

I will pass now to a more exact description of the fungus. As has been said, it affects all green parts of the plants. On the upper side of the leaves it produces small, purplish brown, roundish, or angular spots, either scattered or confluent in larger spots. The attacked leaves dry up and become brown. The sori are at first covered by the epidermis, and afterward break through on both sides of the leaf, especially on the under side. In structure the sori correspond perfectly to the Uredo of a Puccinia. The spores are not surrounded by a pseudo peridium, and are formed singly on pedicels. They are oval, ovate, or pear-shaped, with a thin, uniform, shiny, light yellow membrane and colorless contents. Their length is 24–30μ and their breadth 15–18μ; club-shaped paraphyses are present. The spores germinate in the ordinary manner. Whether this disease is limited to Ecuador or distributed elsewhere I can not now state. Cotton is now cultivated to a less extent than formerly on the coast and perhaps *Uredo gossypii* is the cause. Dr. Rimbach writes me from Cuenca that a cotton disease is known there under the name "Cancha." The name is also given to the diseases of potato, rice, coffee, bananas, etc., so that without the diseased cotton plants for examination it is impossible to say what it represents. Description as follows:

UREDO GOSSYPII, *n. s.*—U. amphigeni. Maculis parvis purpureobrunneis, sparsis vel confluentibus; soris præcertim hypophyllis, flavescentibus; sporis ovoideis, ovalibus, vel pyriformibus; 24–30μ longis, 15–18μ latis, membrana æquali, pallide flavescenti, echinulata, contentu achroo; paraphysibus claviformibus immixtis.

Hab. ad Balsapamba, Prov. de los Rios Æquatoriæ in foliis *Gossypii* sp., parasitica (Dec., 1890).

A NEW DOASSANSIA ON COTTON.

In a search to discover the teleutosporic form of *Uredo gossypii* I unexpectedly found a *Doassansia* on the cotton leaves. As the fruiting bodies of this fungus are not visible to the naked eye, they escaped me

before. So far as I am aware no Ustilagineæ have been observed on Malvaceæ, and on this account I think a short description of *Doassansia gossypii* will not be without interest.

The fruiting bodies form minute black points in the leaf substance. They appear to originate in the same way as Fisch* has described for D. *sagittariæ*, (West) Fisch. The ripe spores are oval, elongated, or pointed, 21–30μ long, 12–15μ broad, often somewhat angular and are firmly bound together. Their membrane is somewhat thick and of a slightly yellowish color, often rather strongly thickened at the corners of the spore. The outer cells are somewhat smaller than the spores, without contents, and with a brown membrane. This species has larger spores than any species of Doassansia known up to this time. Below is a description of the fungus:

DOASSANSIA GOSSYPII, *n. s.*—D. soris rotundatis punctiformibus, minimis, sparsis, atris sporis arcte conjunctis, ovalibus vel oblongis, 21–30μ longis, 12-15μ latis, episporio levi, dilute luteolo, tegumento communi e cellulis minoribus, membrana fusca, levi constituto.

Hab. in foliis Gossypii, spec. ad Balsapamba. Prov. de los Rios, Æquatoriæ.

A NEW PERONOSPORA ON GONOLOBUS FROM SOUTH CAROLINA.

While examining a *Leptopuccinia* collected on an Asclepiad at Quito, and comparing it with *Puccinia gonolobi*, Rav., I found a new Peronospora in considerable quantity on the specimens bearing this fungus (S. C. Mellichamp, Herb. Farlow).

The fungus forms large angular spots bounded by the nerves on the lower surface of the leaves. On the upper side they appear yellowish. The conidiophores are very slightly swollen at the base, several times dichotomously branched, with straight branches pointing obliquely upward. The lower part is 8.5–11μ in diameter. Its membrane is thin and colorless. The end branches are straight and conical, 6–9μ long. The conidia are roundish, ovate, with a pointed end and light violet gray membrane; their length measures 18–24μ and their breadth 16–21μ. I have not found oospores. The characteristics of the species are as follows:

PERONOSPORA GONOLOBI, *n. s.*—P. conidiophoris arborum modo repetite dichotomis ramulis rectis, membrana achroa, ad basim parum inflatis 8.5–11μ latis; ramulis terminalibus rectis 6–9μ longis; conidiis globoso-ovatis membrana pallide griseola 18–24μ longis, 16–21 latis; oosporis ignotis.

Hab. in foliis *Gonolobi* in South Carolina, U. S. parasitica.

QUITO, ECUADOR.

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* C. Fisch, Entwickelungsgeschichte von *Doassansia sagittariæ* (Ber. d. Deutsch. Botan. Ges. Bd. II, 1884.)

DESCRIPTION OF PLATE X.

Figs. 1– 5. *Puccinia heterospora*, B. and C. The spore contents are not drawn with the same magnifying power.
6–21. *Puccinia heterogenea*, n. s.
1– 3. One-celled spores.
4– 5. Two-celled spores.
6– 9. Two-celled spores, of which 7 and 9 have germinated.
10–13. One-celled spores, of which 12 and 13 have germinated.
14. A one-celled spore which has germinated, and the promycelium divided into five cells.
15. A two-celled germinated spore; the promycelium has divided into four cells.
16. Sporidia.
17. A germinated spore whose promycelium has fallen apart into single cells.
18. Isolated cells of the promycelium.
19–21. Spores which have germinated in water and formed a long germ tube. In Fig. 21 the germ tube is branched at the end.

REVIEWS OF RECENT LITERATURE.

BREFELD, OSCAR.—*Untersuchungen aus dem Gesammtgebiete der Mykologie. Heft IX.* Munster i. W. 1891, pp. VIII, 156, pl. 4.

This indefatigable German botanist has recently given to the press the ninth part of the above work, and by this time no doubt has the tenth part before the public. These two parts represent 10 years of investigation, the last four of which have been entirely devoted to this work. Owing to the loss of one eye he has been obliged to have the constant help of an assistant, whose aid he acknowledges both in the prospectus and on the title page. The assistants in the work were Dr. Franz von Tavel and Dr. Gustav Lindau.

Dr. Brefeld feels that with the issue of these two parts and the plans of three more in hand, he can at least fully claim that he has laid the foundation for a natural system in the classification of fungi—a system which hitherto has made itself painfully conspicuous by its absence, and which can not be too warmly welcomed, or too thoroughly studied by American mycologists.

Part IX consists of five divisions. The first division is explanatory of the rest. The second takes up spermatia and their culture in nutrient solutions, shows that they are capable of germination and independent development and hence are a form of asexual reproduction distinguished from other spore forms only by their size.

Division 3 deals with the asci of Ascomycetes in their relation to basidia and simpler fruit forms. In this the author traces the relationship between conidia and sporangia and attempts to establish that the former is only a variation of the latter. Starting with these two he traces the